

## *Introduction to the Congress*

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### DESIGNING THE FUTURE OF THE FORESTRY SECTOR SILVOSISTEMICA: TO KNOW IS TO ACT

A different era requires different behaviors. After analyzing the context in which the first International Congress of Forestry was organized, the paper highlights the need for a cultural change in thought and in forestry research.

The second part of the report underlines the need to adopt a systemic vision and to recognize the rights of the forest. The work also presents the Silvosistemica as a project for the future of the forest sector.

*Keywords:* scientific revolution, systemic view, rights of the forest, systemic silviculture, Silvosistemica.

*Parole chiave:* rivoluzione scientifica, visione sistemica, diritti del bosco, selvicoltura sistemica, Silvosistemica.

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#### 1. *Alia aetas alios mores postulat*

Another age demands other customs. The first World Forestry Congress took place in Rome from April 29 to May 5, 1926. Eighty-eight years have passed since then. Much has changed in science, technology, and practice.

That Congress dealt primarily with questions of practice that were handled in different ways in various real-life situations. Among the many issues that arose was a scientific-practical change proposed by HENRY BIOLLEY (1858-1939), about which there was a wide-ranging debate. It concerned the so-called *control method*, which was opposed by ROBERT HICKEL (1861-1935), AMERIGO HOFMANN (1875-1945), and GIUSEPPE DI TELLA (1876-1942).

In spite of all this, HENRY BIOLLEY rigorously implemented *le jardinage cultural* and *la méthode du contrôle* in the Couvet Forest in the Canton of Neuchâtel. The Couvet Forest then (what a coincidence!) became a destination for supporters of the control method and, as Bourgenot (1975) writes, the “Mecca of Uneven Agedness.” It’s not surprising. Changes in the forestry sector occur at the pace of forests themselves: slowly, sometimes very slowly. But actually this happens in almost all areas of science.

The first Congress took place, therefore, in the century when knowledge was founded on *exact sciences* (nomothetic) and usually acquired through experiments, that is, with Galilean methods. It was a century during which nothing was considered scientific if it was not consistent with the just-mentioned conceptual lines and methodologies, or, in other words, if it was not *reversible, simple, immutable, predictable, and repeatable*.

ALAN TURING (1912-1954) had not yet stated the theories of Artificial Intelligence (AI) and computer science. There were no computers to allow great progress in the cognitive, scientific, and technological realms. Technology, or what we mean by it today, remained confined to the minds of a very few scientists who conducted research that was absolutely new and highly complex. At that time, there was still no glimpse of what evolutionary epistemologists would later define as “the challenge of complexity.”

In the 1930s a change was wrought in the physical sciences that could be called exceptional and, precisely for this reason, extraordinarily important. Most physicists accepted the theory of quantum mechanics, disregarding the opinion of ALBERT EINSTEIN (1879-1955), who summarized his objection to the new theory with the famous aphorism, “God does not play dice with the Universe!”

This fundamental change was worked out by the Copenhagen and Göttingen School of NIELS BOHR (1885-1962), WERNER HEISENBERG (1901-1976), and MAX BORN (1882-

1970). It was a change that provoked more than a few disputes. But scientific revolutions – as understood by THOMAS KUHN (1922-1996) in the famous book (1962) *The Structure of Scientific Revolutions* – involve controversies that conclude only when new ideas put forward by the individual scientist are accepted by the scientific community, or at least by a broad segment of it.

In the 1970s, *procedural sciences* – developmental or historical – were set up as a contrast to *exact sciences*, with the corresponding concepts of *irreversible*, *complex*, *variable*, *unpredictable*, and *unrepeatable*. The contrasting categories of these two approaches to science are shown in Table 1, although perhaps in a greatly simplified and only approximate manner.

If we examine the two sets of terms delineating the different groups of sciences, obviously explained only concisely and incompletely, the elements of the contrast stand out clearly and unmistakably. The new theories and ideas have been, and still often are, considered to be unscientific or to be at the very limits of acceptable science.

It should be noted, however, that in recent years the most reputable researchers in the life sciences have become more accepting of this new methodology. Attempting to explain the issue very simply, we can state that in the study of nature, the principles of reductionism, determinism, and mechanism – in brief, Newtonian mechanics – prevail in the *exact sciences* as methods of research, while in the *procedural sciences*, holism, organicism, and systems thinking are taken into consideration.

Table 1. Contrasting conceptual features of the exact sciences (nomothetic) and procedural sciences (developmental or historical).

PROPERTIES OF THE EXACT SCIENCES		PROPERTIES OF THE PROCEDURAL SCIENCES
1	Order	Disorder
2	Simple	Complex
3	Repeatable	Unrepeatable
4	Immutable	Variable
5	Predictable	Unpredictable
6	Reversible (linear paradigm)	Irreversible (non-linear paradigm)
7	Tautological propositions	Original propositions
8	Changes are not taken into account	Changes are imponderable
9	Models of abiotic systems	Models of biotic systems
10	Regularity	Chaoticity
11	Reductionism	Holism
12	Mechanism	Aleatority
13	Determinism	Indeterminism
14	Cause-effect	Chance
15	Maximizing profit	Evaluating environmental and social impact
16	Current-day orientation	Innovative orientation
17	Market value	Social value
18	Quantitative predictions	Qualitative theories

## 2. Silvosistemica as a way to design the future of the forestry sector

With the description of the discipline of *Silvosistemica* I intend to present a “design for the future of the forestry sector.” This attempt is based on a principle: the re-examination, from the scientific and cultural point of view, of the forest, an entity whose definition entails conceptual and methodological innovation. “*The forest is a unified whole in the network of relationships between the complex of animal and plant organisms and the*

*complex of physical factors – in other words, a highly complex biological system.*” In short, it is a system to which the notion of *complexity* is tightly bound.

However, out in the field, the ideas of system and complexity are very often not held in the proper regard and are ignored. Those advocating that these ideas of system and complexity should form the basic principles of the disciplines of forestry science almost always sense incomprehension and realize that controversies are likely to come. This stems as a matter of course from the well-established conviction among researchers and foresters that such ideas do not belong in the *exact sciences*, which are characterized by the formulation of universal laws of nature that, precisely because they are such, should be capable of generating exact predictions.

In the scientific arena, innovative ideas are subjected to various dialectical debates. It has always happened, and it always will happen. But this is not the issue. The big trouble arises when methods are separated from science. This disjunction appears incomprehensible to many foresters. It seems almost as if one wished to deny the validity of normally accepted methods.

A second principle is connected to the awareness of moving from specialized knowledge to general knowledge, which is not the recognition of a set of methods suitable to solve specific problems, but is the *re-discovery* of the *procedural sciences* that can provide hypothetical reconstructions of a sequence of events within a no longer modifiable context. This is a re-discovery that concerns not only the intellectual sphere, but also the ethical one, to which pertains the concept of responsibility toward all biotic and abiotic forms of nature.

This attempt involves a paradigm shift in which the forest is studied using the categories of *order/disorder* and *simple/complex*. The mechanism and determinism typical of forestry science, as it is understood today, lead unavoidably to a form of anthropocentrism based on the *criterion of very weak sustainability*, or the mistaken belief that science and technology can make up for the damage that humans inevitably cause in the *complex biological forest system*.

The *procedural sciences* make no room for the categories of *order* and *simple* and turn the opposing categories of *disorder* and *complex* into the focal point and priority of research and inquiry into the forest. The study of nature poses questions that can only be answered through modeling the great diversity of nature. Considering the more or less radical modification of this diversity represents a preposterous, unacceptable conceptual heresy.

But the history of thought and of forestry science clearly shows that this has been the road constantly travelled. And, unfortunately, it continues in that way due to the firm belief in the effectiveness of the unnatural path.

Forestry research has developed decisively along the lines of this contrast. Looking to the past and remaining immobile when ecological, scientific, cultural, ethical, social, and political changes are appearing at an unpredictable and incredibly fast pace would mean, on the one hand, insulting nature, and on the other, damaging not only current generations, but also and especially those to come.

It should be added that the collective conscience of foresters has not yet accepted the new *Weltanschauung* that calls for a new and different research methodology. This has brought about passionate debates among the supporters of principles conforming to experimental science and the proponents of the conceptual categories of this new view. But this is a positive step. Debate is always useful. As I like to put it, “*Discord brings knowledge, and knowledge increases ignorance.*”

The change in the epistemological foundations of scientific research in forestry has led me to present a few ideas aimed at developing a scientific and technical design for a new view of the complex biological forest system.

### 3. The systemic view and the rights of the forest

In recent years, there has been a profound change among the most advanced segments of society. New discoveries in science – notably in the various forms of ecology:

*philosophical, scientific, technological, cultural, and ethical* – and the awareness of the limits of development, which has not acknowledged the need to protect and respect the environment, have led to the beginnings of a different relationship between humans and nature and, as a result, between humans and the forest.

By now it is universally recognized and accepted that, as HAZEL HENDERSON maintains, we are all enclosed in a series of systems, each nestled within another. This leads to a new view: the *systemic view*, which allows us to perceive the importance and significance of complexity and the connections between the natural world and the human one. *Systems theory* is confirmed. The *holistic view* takes shape. So, even if we are not referring to conventional holism here, it must be noted that complexity involves the principle of incompleteness and uncertainty that is observed when investigating living systems.

The reinterpretation of developments in forestry in the 20<sup>th</sup> century and the advances in knowledge that ensued in forestry and environmental sciences led to a change in how the forest is approached conceptually. The starting point for this deliberation is how knowledge and values are perceived: in other words, epistemology and axiology.

Many people will not attribute a “value in and of itself” to the forest. Others, however, believe that the forest has the right to exist, and thus, as some philosophers and a number of forestry academics have pointed out, the question of rights is unavoidable. All that will be left to debate is the priority and limits to be assigned to each of the rights vis-à-vis the others.

Critical analysis of *systems thinking* leads to the implicit conclusion that it is time to consider the forest no longer to be the *object* but the *subject of rights* and, accordingly, to take this into account. I am and want to remain *au dessus de la mêlée*, and I also know that I’m running the risk of being considered heretical and, consequently, of being excommunicated. But even though I’m aware of all this, I’m not going to back down. I will complete my attempt to provide a credible explanation.

In recent years, much has changed concerning the forest: we are faced with issues relating to daily operations and to the obligation to respect the forest, as nature teaches us in its various expressions. The forest is a living system with value in and of itself and which, for this very reason, has those rights we recognize for the biotic community. *The rights of the forest*, to be precise.

#### 4. The definition of the “third way”: Silvosistemica

Forestry as theorized and practiced in the 19<sup>th</sup> and 20<sup>th</sup> centuries developed according to the canons of *Classic Silviculture*.<sup>2</sup> The objective was and is to earn the maximum return in the shortest possible time with the minimum expense of energy, labor, and capital; this is the viewpoint of those advocating *anthropocentrism*. In the final decades of the 20<sup>th</sup> century, *ecocentrism* arose in opposition. It was closely identified with the ecosophy and ecology of ARNE NAESS (1912-2009).

Those who back anthropocentrism consider the forest an asset to be exploited according to the desires and interests of humans. The proponents of ecocentrism believe, on the other hand, that the forest must be protected independently of the fulfillment of human needs.

At the end of the 20<sup>th</sup> century, this split between anthropocentrism and ecocentrism led to the idea of imagining a *tertium quid* that could create an innovative system out of the two different philosophical approaches. It could reconcile and harmonize them so as to define a *third way*, to use current terminology (Ciancio, 1981; 2011).

The *third way* takes neither the extreme of Scylla, which demands the objectification of predictable results from science, nor that of Charybdis, which manifests a solipsism denying ties to other aspects of forestry. In my opinion, researchers must steer a course that allows them to acknowledge the findings of one or the other side.

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<sup>2</sup> The definition of *Classic Silviculture* suggests the different forms of silviculture that have been practiced over time: sustained yield forestry, ecological forestry, close-to-nature forestry, and naturalistic forestry in its various expressions.

Human awareness and inventiveness, expressions of the *mind* and *intellect*, are becoming *experiences* produced by nature and, at the same time, capable of controlling natural events and of dominating and directing those that have been produced. The concept of JOHN DEWEY (1859-1952), “Man in nature is man subjected; nature in man, recognized and used, is intelligence and art,” should permit a cultural “mutation” and a renewal of forestry thinking.

Such a theory presupposes interdependence between the action of humans and the reaction of the phytocoenosis – as a synthesis and result of a reciprocal adaptation – that, as such, naturally gains widespread interest, takes on universal importance, and forms a starting point for identifying or developing the so-called *third way*.

Until the 1960s, forests were treated according to a technocratic concept of exploitation. This has already been noted. Newtonian mechanism characterized forestry research. This is a simplification that in epistemological terms is inspired by the Cartesian concept of dualism between “*res cogitans*” and “*res extensa*,” that is, by the clear separation between the world and the self, or between matter and spirit. It is a culture that has dominated and continues to dominate. It is a fact. Three centuries later, despite scientific and technological progress, such concepts still enjoy a broad acceptance in the forestry community.

The very definition of the so-called *third way* – which is based on systems, chaos, and complexity theory – entails moving past these two positions, especially in the case of *Silvosistemica*, a discipline that seeks to conserve resources and to use appropriate technology for proper interaction with nature. The natural system is considered autopoietic, or capable of perpetuating itself autonomously, and the systemic approach is inspired by the scientific concept of “trial and error” – by attempts and successive approximations (Table 2). Yet many in the forestry community raise the following question: what do we mean by *Silvosistemica* in operative terms? If by *Silvosistemica* we mean a certain form of cultivation, a certain process, that more or less protects the continuation of production, well, then, we would be traveling well-worn paths. These paths, to be honest, are one-way and confining, since they are scientifically limited to a deterministic view that leaves little room to the forest as a system and as a thing of value.

Table 2. The *third way*. Criteria for sustainability concerning schools of thought in ecology, the type of economy, and strategies of environmental management.

THE <i>THIRD WAY</i>	
<i>Sustainability Criterion</i>	Strong
<i>Type of Development</i>	Sustainable development
<i>Type of Value</i>	Nature has intrinsic value
<i>Features of schools of thought in scientific ecology</i>	Systems theory, chaos theory, complexity theory. Reflections on environmental topics. Self-organization theory. Decision-making processes in uncertain conditions
<i>Features of philosophical schools of thought in ecology</i>	Scientific ecology. Appropriate technology. Mistakes regarding the environment are corrected; protection and preservation of resources
<i>Scientific method</i>	Autopoiesis. Trial and error
<i>Ethics</i>	Recognition of collective interests and those of the ecosystems. Equity in access to resources intragenerationally and intergenerationally
<i>Type of economy</i>	Economy steered by economic incentives (e.g. payment for benefitting the ecosystem, tax breaks)
<i>Management strategy</i>	Economic growth guided and limited. Regulated management

*Silvosistemica* is a kind of “extensive forestry,” in harmony with nature, whose purpose is an *autopoietic forestry system*, an extraordinary complex system capable of self-organization. The concept of the forest as a system returns to debate the very premises of silviculture, forestry management, and forestry economics. *Silvosistemica* imagines a non-homogeneous forest. Cultivation efforts are designed to support the relationship between the parts that make up the system, favoring the interaction between them and the environment. At the same time, *Silvosistemica* is both “one” and “varied” in relation to the differing aspects of the physical, biological, social, historical and cultural order and puts us on the right path toward settling the “forestry question.”

Indeed, if we eliminate a priori the *insularity principle* inherent in *Classic Silviculture* and substitute the *polarity principle* for it, in which opposites in a methodological continuum lead to an understanding of the plurality of aspects, then a new synthesis is possible, one in which the premises of *Silvosistemica*, as enunciated many times previously (Ciancio, 1999; 2009; 2010), become suitable propositions for *designing the future of the forestry sector*.

In the *third way*, sustainable development is therefore pursued through a just sharing of resources within this generation, and between generations. Humans act in order to make the most of natural resources so as to obtain the maximum and best use, as a suitable and necessary means toward surviving and maintaining life. The economy is supported by incentives and payments for environmental and ecosystemic benefit. Economic growth is steered and limited by an insurmountable constraint: the *limit of the possible*.

## 5. Rival features in Classic Silviculture and Silvosistemica

At the theoretical level, during research *Classic Silviculture separates the forest* from the researcher, who inquires in the manner prescribed by the Cartesian-Newtonian scientific paradigm. That's not surprising. We need only reflect on the words of Albert Einstein: “*The belief in an external world independent of the perceiving subject is the basis of all natural science.*” In short, he was convinced of the need to proceed as dictated by the *exact sciences*.

By contrast, *Silvosistemica* assumes a different epistemological foundation: a relational *nexus* between forest and researcher. During research there is always an interaction between the object under investigation and the observer. As a result, in the present case the observer examines the forest in the manner dictated by the holistic and systemic paradigm. In a nutshell, the principles of the *procedural sciences* are applied.

The difficulties facing some forestry specialists and forestry ecologists in understanding and adhering to *Silvosistemica* stem from (a) the importance they lend to the objective description of the forest; and (b) from the unusual (at least for them) active, effective, and decisive integration of humans into the experimental process.

Scholars, scientists, and researchers who believe their own disciplines are nomothetic do not take into account the conceptual and methodological foundations of the developmental sciences. And it is due to this basic principle that scientific and cultural communities form and oppose each other over problems within the same discipline. A few examples? Physics: Classical mechanics, quantum mechanics. Biology: molecular biology, developmental biology. Forestry: Classic Silviculture, Silvosistemica.

This different conceptual position is due primarily to the traditional ideology of *Classic Silviculture*, which is closely tied to wood production, and thus to *dogmatic realism*. This conception mirrors Einstein's, who considers “*dogmatic realism as the basis of natural science.*”

Such a *modus operandi* is due to *imprinting*, the premature learning acquired in the Forestry Schools which has penetrated deeply into the mentality of foresters and forestry ecologists and even now is the position of many researchers who base their work on *dogmatic realism* without appreciating that, as I'm fond of putting it, “*The rational order of the forest, which is the goal of Classic Silviculture, represents the maximum natural disorder.*”

With *Silvosistemica* we are well aware that we can know the forest beyond what is permitted by *dogmatic realism*, freeing silviculture from the enormous conceptual and operational burden that blocked and unfortunately continues to block the way toward new horizons and future scientific and technical perspectives.

## 6. Forestry systems in comparison

In forestry the success of the *systemic view* based on the holistic and systemic paradigm makes possible the establishment of the *autopoietic forestry system*, i.e. a non-linear system which is capable of combining functional efficiency with a high economic, cultural, and ecological value, in contrast to the *classic forestry system*, i.e. an analytic linear system which aims to maximize profit with commercial use of wood (Table 3).

The *classic forestry system* is based on the principle that provisional estimates of wood production have a linear analytic nature. Moreover, it follows specific standards and, precisely for this reason, lacks alternatives. A linear system involves an approach to cultivation that aims at the uniformity and homogeneity of the forest and, consequently, at the reduction of biodiversity and loss of genetic information.

Table 3. Comparison of the main features of the *classic analytic linear forestry system* and the *non linear autopoietic forestry system* (from CIANCIO, 1999).

<i>CLASSIC ANALYTIC LINEAR FORESTRY SYSTEM</i>	<i>NON LINEAR AUTOPOIETIC FORESTRY SYSTEM</i>
Linear system, few options	Non-linear system, abundant options
Uniformity and homogeneity of the system	Divergence and non-homogeneity of the system
Reduction of diversity and loss of genetic information	Diversity is the source of genetic information, has cultural value and value in use
<i>MANAGEMENT</i>	<i>MANAGEMENT</i>
Uniformity in cultivation requires centralization of control as a function of profit and the market	Diversity in cultivation requires decentralization of control and places value on "local knowledge"
Forest rigidly organized into chronological classes or diametric classes	Unstructured forest, capable of self-organizing
Uniformity of products; mainly wood	Diversified products: wood is only one of them
<i>ECOLOGICAL EVALUATION</i>	<i>ECOLOGICAL EVALUATION</i>
Stable and sustainable system with introduction of energy, labor, and capital. Productivity, profit, and economic value are <b>independent of the ecosystem</b>	Stabile, sustainable, and renewable autonomously. Productivity, profit, and economic value are <b>dependent on the ecosystem</b>
<i>PRIMARY OBJECTIVE</i>	<i>PRIMARY OBJECTIVE</i>
Maximization of profit by commercial use of the forest	Preservation of the biodiversity and complexity of the system

The predominant, if not exclusive, emphasis placed on wood production has brought about a one-dimensional forestry paradigm aimed at systematizing and maximizing income from the land. The *classic forestry system* is a stable and sustainable system in the short run. However, in the long run the system becomes unstable and unsustainable, since the glorification of production works to the detriment of other factors indispensable to the resilience of the forest, making it highly unlikely, and even impossible, that the ecosystem's functionality can be optimized.

Productivity, profit, and economic value are *independent of the ecosystem*, while sustainability is *dependent* on introducing energy, labor, and capital. This means that production is tied to a high level of external inputs. And because this weighs heavily on the equilibrium of the ecosystem, it has led to an increased ecological vulnerability and instability, a huge erosion of biodiversity, the lack of alternatives, and poor options.

The *autopoietic forestry system*, on the other hand, is a "non-linear system" that is rich in biodiversity and capable of providing alternatives, since it does not follow prescribed rules and undergoes rapid variation when adapting to diverse conditions. A system of this sort entails a cultivation philosophy aimed at conservation or increasing biodiversity and, thus, at divergence and non-homogeneity. In other words, it is aimed at the complexity of the forest. It can satisfy society's requirements, achieve functional efficiency of the ecosystem, and steer the *silvosistemi* toward environmental balance. Management is sustainable because it prioritizes the potential of supplying the various benefits and products of the forest.

Productivity, profit, and economic value are *dependent on the ecosystem*. Meanwhile, sustainability is *independent* of the introduction of energy, labor, and capital. This means that production is tied to a low level of external inputs. And because it does not significantly bear on the ecosystem's equilibrium, this leads to an increased ecological stability, the ability to preserve or increase biodiversity, an abundance of alternatives, and valuable options.

## 7. Foreshadowing the possible future

The forestry community must move beyond the idea of achieving the maximum *direct and indirect utility*, which often means exploitation for the sake of exploitation. It will take a *new deal*, a new mindset, and a new philosophical perspective on nature; or, if you will, a new way of seeing the forest. We must think of the forest not only in practical terms, but also in a metaphysical, aesthetic, and ethical sense. And this is how *Silvosistemica* foreshadows the possible future.

The forest affects everyone, but foresters in particular. Yet they must still win their most difficult match: attaining consensus and credibility. However, consensus cannot be imposed. It is won. And in order to win it, both knowledge that is already at hand and that yet to be obtained must be submitted for review by a much broader community than just the scientific one. The idea of complexity introduces a fitting disorder into the unnatural hierarchy in which an exacerbated and excessive attention to detail constrains the forest. Without forgetting the past, we must envision the future.

We are living in an historic moment in which the vision of the world groans under the pressure generated by the *speed of evolution* and the *culture of complexity*. In a way understandable by everyone, foresters must make known how far their horizon of knowledge has advanced. To communicate is to debate and inform. This means being aware that the more we learn, the more we discover *forests of ignorance* around us. Building a "forestry culture" that is open to the outside world requires the ability to open it from the inside.

The *spirit*, the *essence of Silvosistemica*, cannot and must not be judged solely by one sector's constraining view, which is not derived from the actual practice of cultivation. Nor should this practice be evaluated in terms of a single era, or worse still, of "*fashion*," with a *pragmatic* or (more or less) *ideal* or *mystical purpose*. On the contrary, it should be appreciated with a broader view, one with more distant horizons, and one independent and not subjugated to a rigidity and an over-simplification which are useful only for

didactical purposes. Then, in a spirit of modern *humanistic naturalism*, a unique combination can be forged: of thought with science, of art with the technical, and of ethics with the natural, economic, and social.

I would like to conclude with an aphorism by Petronius – *Satyricon* cap. XLIV – which in the logo of the Italian Academy of Forest Sciences is referred to a tree: «*Serva me, servabo te*».

#### RIASSUNTO

##### PROGETTARE IL FUTURO PER IL SETTORE FORESTALE LA SILVOSISTEMICA: CONOSCERE PER OPERARE

Una diversa epoca esige modi di comportamenti diversi. Dopo aver analizzato il contesto di riferimento in cui fu organizzato il primo Congresso Internazionale di Selvicoltura, il lavoro evidenzia la necessità di un cambiamento culturale nel pensiero forestale e nella ricerca.

Nella seconda parte della relazione, si sottolinea l'opportunità di adottare una visione sistemica e di riconoscere i diritti del bosco, e si presenta la *Silvosistemica* come progetto per il futuro del settore forestale.

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